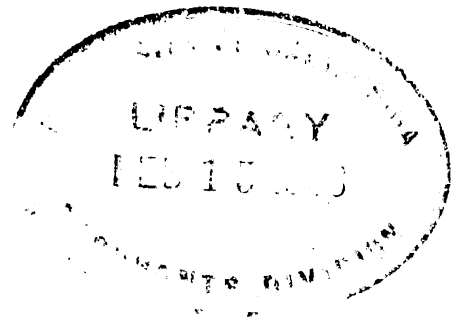
TM 11-344

WAR DEPARTMENT

# TECHNICAL MANUAL

# CONVERTER M-222

January 8, 1943



TECHNICAL MANUAL

# CONVERTER M-222

CHANGES No. 1

WAR DEPARTMENT,
WASHINGTON, March 23, 1943.

TM 11-344, January 8, 1942, is changed as follows:

14. **Components, weights, and dimensions.** (Superseded.)

516703°—43

| Stock No. | Name of part | Dimensions (inches) | | | | Unit weight (pounds) | Mfr. Drawing No. | Mfr. Code | Description | Function | Drawing or Spec. No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Height | Width | Depth | Diameter | | | | | | |
| 4F222/B2 | Box assembly<br>1 Box.<br>4 Brackets.<br>2 Catch fasteners.<br>1 Handle.<br>1 Switch mounting. | 8¼ | 6¾ | 6⅝ | | 2.54 | A-325 | | Steel, rectangular | | SC-D-7909.<br>SC-D-7910, Item 4. |
| 3E4059-4 | Connector, battery | | | | | | S-226 | | Green wire, 5 in. long, No. 18 A. W. G., with a terminal lug on each end. | To connect 2 batteries | SC-D-7908, Item 29. |
| 4F222/C2 | Cover assembly, right<br>1 Cover.<br>2 Clips. | 6 13/16 | 5 13/16 | ½ | | .8 | A-447 | | | | SC-D-7910, Item 3.<br>SC-D-7911, Item 6. |
| 4F222/C1 | Cover assembly, left<br>1 Cover.<br>2 Clips. | 6 13/16 | 5 13/16 | ½ | | .84 | A-450 | | | | SC-D-7910, Item 2.<br>SC-D-7911, Item 8. |
| 4F222/J1 | Insulator | 2½ | 5 3/32 | ¾ | | | | | | | |
| 4F222/L1 | Label, circuit | | | | | | F-1450 | | | | SC-D-7914-B. |
| 4F222/M1 | Mounting shelf assembly. | 6 21/32 | 3⅝ | 5 1/16 | | 5.12 | | | | | SC-D-912. |
| 3D234 | 1 Capacitor CA-234. | | | | | | | | 1-μf, 200-volt d-c, 0.25-μf, 200-volt d-c. | Output buffer. Vibrator actuating point suppression. | Spec. 71-516.<br>SC-D-512. |
| 6Z4920 | 1 Grommet | | | | | | | | | | |
| 4F222/J2 | 1 Insulator | | | | | | | | | | |
| 4F222/M1/1 | 1 Mounting shelf | | | | | | | | | | |
| 2Z8659-7 | 1 Socket, 6-prong | | | | | | | A. P. C. | 6 contact molded phenolic type 7255. | Vibrator socket | |
| 6L30555 | 2 Spacers | | | | | | | | | | |
| 3Z12050-2 | 1 Terminal, brass tinned. | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4F222/T1 | 1 Transformer assembly | | | | | | | E. L. I. | 3 volts d-c vibrator input. 100 volts a-c output Type T-521-A. | Power | |
| 2Z9625 | 1 Transformer | | | | | | | | | | |
| 4F222/T1/1 | 1 Half shell | | | | | | | | | | |
| 4F222/T1/2 | 1 Half shell (with 2 Grommet holes). | | | | | | | | | | |
| 6Z4920 | 2 Grommets, rubber. | | | | | | | | | | |
| None | Name plate | | | | | | F-1449 | | | | |
| 6Z7788 | Receptacle | | | 1 | 1¼ | .08 | S-281 | H.H.I. | 2 contact molded phenolic Type 7255. | Output voltage connection. | |
| 6L4116-2.1 | Rivets, brass | | | | | | | | 3/32" x 5/32" | | |
| 6L4117-2.15 | Rivets, steel | | | | | | | | 1/8" x 5/32" | | |
| | Screws, nuts and lockwashers: | | | | | | | | | | |
| 6L6632-5.85 | Screws No. 6-32 | | | | | | | | 5/16" long | | |
| 6L6832-4.85 | Screws No. 8-32 | | | | | | | | ¼" long | | |
| 6L6832-5.85 | Screws No. 8-32 | | | | | | | | 5/16" long | | |
| 6L6832-8.85 | Screws No. 8-32 | | | | | | | | ½" long | | |
| 6L3106-32GS | Nuts No. 6-32 | | | | | | | | Steel electro galvanized hex (standard). | | |
| 6L3108-32.8GS | Nuts No. 8-32 | | | | | | | | Steel electro galvanized hex (½" across Flt.). | | |
| 6L70006 | Washers | | | | | | | | For No. 6 screw | | |
| 6L70008 | Washers | | | | | | | | For No. 8 screw | | |
| 4F222/S1 | Strip, phenolic | ½ | 4 3/8 | ½ | | | L-926 | | | | SC-D-7910, Item 5. |
| 3Z8105 | Switch SW-105 | 1 5/8 | 1 | ½ | | | E-79 | | Toggle | Input voltage On-Off switch. | SC-A-1042. |
| 3Z12050-1 | Terminals, brass, tinned. | | | | | | U-524 | | | | SC-D-7908, Item 17. |
| 4F222/V1 | Vibrator | 3 5/16 | 5 3/8 | 2¼ | | 1.18 | AA-1119 | E.L.I. | 3 volts 24 cycles±4 cycles Type S-81A-U. | To change input d-c voltage to a-c and apply it to the transformer. | |
| 1B518.12 | Wire | | | | | | | | No. 18 A.W.G. blue | | |
| 1B518.11 | Wire | | | | | | | | No. 18 A.W.G. red | | |
| 1B518.7 | Wire | | | | | | | | No. 18 A.W.G. green | | |

[A. G. 062.11 (2-27-43).] (C1, Mar. 23. 1943.)

15. (Superseded). **Replaceable parts.**—All items listed in **paragraph 14** are replaceable.

[A. G. 062.11 (2-27-43).] (C 1, Mar. 23, 1943.)

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
*Chief of Staff.*

OFFICIAL:

J. A. ULIO,
*Major General,*
*The Adjutant General.*







U. S. GOVERNMENT PRINTING OFFICE: 1943

Lus War Dept;

TECHNICAL MANUAL

# CONVERTER M-222

CHANGES No. 2

WAR DEPARTMENT,
WASHINGTON 25, D. C., 11 December 1943

TM 11-344, 8 January 1943, is changed as follows:

**14. Components, weights, and dimensions** (as changed by C 1) *

* The individual items in this change will be cut apart and pasted over the specific paragraphs or subparagraphs affected. This change together with TM 11-344, 8 January 1943 and Changes No. 1, 23 March 1943, thereto, supersede TM 11-344, 16 March 1943.

562894°—45

| Signal Corps Stock No. | Name of part | Dimensions (inches) | | | | Unit weight (pounds) | Mfr. Drawing No. | Mfr. code | Description | Function | Signal Corps Drawing or Spec. No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Height | Width | Depth | Diameter | | | | | | |
| 4F222/B2 | Box assembly | 8¼ | 6¾ | 6⅝ | | 2.54 | A-325 | | Steel, rectangular | | SC-D-7909, Item 1. |
| | 1 Box | | | | | | | | | | SC-D-7910, Item 4. |
| | 4 Brackets | | | | | | | | | | |
| | 2 Catch fasteners | | | | | | | | | | SC-D-7911, Item 10. |
| | 1 Handle | | | | | | | | | | SC-D-7911, Item 11. |
| | 1 Switch mounting | | | | | | | | | | |
| 3E4059-4 | Connector, battery | | | | | | S-226 | | Green wire, 5 in. long, No. 18 A.W.G., with a terminal lug on each end. | To connect 2 batteries. | SC-D-7908, Item 29. |
| 4F222/C2 | Cover assembly, right | 6 13/16 | 5 13/16 | ½ | | .8 | A-447 | | | | SC-D-7910, Item 3. |
| | 1 Cover | | | | | | | | | | SC-D-7911, Item 8. |
| | 2 Clips | | | | | | | | | | |
| 4F222/C1 | Cover assembly, left | 6 13/16 | 5 13/16 | ½ | | .84 | A-450 | | | | SC-D-7910, Item 2. |
| | 1 Cover | | | | | | | | | | SC-D-7911, Item 6. |
| | 2 Clips | | | | | | | | | | SC-D-7911, Item 9. |
| 4F222/J1 | Insulator | 2½ | 5 21/32 | ¾ | | | | | | | SC-D-7912, Item 12. |
| 4F222/L1 | Label, circuit | | | | | | F-14, 50 | | | | |
| 4F222/M1 | Mounting shelf assembly | 6 21/32 | 3⅝ | 5 11/16 | | 5.12 | | | | | Spec. 71-516. |
| | 1 Capacitor CA-234 | | | | | | | | 1-μf, 200-volt, d-c, oil | Output buffer | |
| 3D234 | 1 Capacitor CA-385 | | | | | | | | 0.25-μf, 200-volt d-c, oil | Vibrator actuating point suppression. | SC-D-612. |
| 3D385 | 1 Grommet | | | | | | | | | | |
| 6Z4920 | 1 Insulator | 5 21/32 | | | | | | | | | SC-D-7913, Item 3. |
| 4F222/J2 | 1 Mounting shelf | | 3 5/8 | 5 11/16 | | | | | | | SC-D-7913, Item 1. |
| 4F222/M1/1 | 1 Socket, 6-prong | | | | | | | A. P. C. | 6-contact, molded phenolic type M1P6. | Vibrator socket | |
| 228660-1 | | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6L30555 | 2 Spacers | | | | | | | | | | SC-D-7913, Item 2. |
| 3Z12050-2 | 1 Terminal, brass tinned. | | | | | | | | | | SC-D-7908, Item 17. |
| 4F222/T1 | Transformer assembly | | | | | | | | | | |
| 2Z9625 | 1 Transformer | | | | | | | S. M. C. | 3 volts, d-c vibrator input, 100 volts a-c output, type T-521-A. | Power | |
| 4F222/T1/1 | 1 Half shell | | | | | | | | | | |
| * | * | | | * | | | | * | * | * | * |
| 6Z4920 | 2 Grommets, rubber. | | | | | | | | | | |
| None | Name plate | | | | | | F-14, 49 | | | | SC-D-7910, Item 7. |
| 6Z7788 | Receptacle | | | 1 | 1¼ | .08 | S-281 | H. H. I. | 2-contact, moulded phenolic Type 7255. | Output voltage connection. | |
| * | * | | | * | | | | * | * | * | * |
| 4F222/S1 | Strip, phenolic | ½ | 4⅜ | ½ | | | L-926 | | | | SC-D-7910, Item 5. |
| 3Z8105 | Switch SW-105 | 1⅝ | 1 | ½ | | | E-79 | A. H. H. | Toggle | Input voltage On-Off switch. | SC-A-1042, Item 14. |
| 3Z12050-1 | Terminals, brass, tinned. | | | | | | U-524 | | | | SC-D-7908, Item 17. |
| 4F222/V1 | Vibrator | 3 5/16 | 5⅜ | 2¼ | | 1.18 | AA-1119 | E. I. I. | 3 volts, 24 cycles±4 cycles, type S-81A-V. | To change input d-c voltage to a-c and apply it to the transformer. | |
| 1B518.12 | Wire | | | | | | | | No. 18 A. W. G., blue | | |
| * | * | | | * | | | | * | * | * | * |

[A. G. 300.7 (20 Nov 43).] (C 2, 11 Dec. 43.)

## 16. List of manufacturers.

| *Code* | *Name* | *Address* |
|---|---|---|
| * | * | * |
| H. H. I---- | Harvey Hubbel, Inc---------- | Bridgeport, Conn. |
| **A. H. H----** | **Arrow, Hart & Hegeman Co--** | **Hartford, Conn.** |
| **S. M. C----** | **Silman Manufacturing Corp-** | **Pittsburgh, Pa.** |

[A. G. 300.7 (20 Nov 43).] (C 2, 11 Dec 43.)

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
*Chief of Staff.*

OFFICIAL:
J. A. ULIO,
*Major General,*
*The Adjutant General.*





U. S. GOVERNMENT PRINTING OFFICE, 1943

TECHNICAL MANUAL

# CONVERTER M–222

CHANGES No. 3

WAR DEPARTMENT
Washington 25, D. C., 4 January 1945

TM 11–344, 8 January 1943, is changed as follows:



SECTION I

## MAINTENANCE

*Note.*—(Added.): Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on WD AGO Form 468 (Unsatisfactory Equipment Report). If Form 468 is not available, see TM 37–250. Failure or unsatisfactory performance of equipment used by Army Air Forces will be reported on Army Air Forces Form 54 (Unsatisfactory Report).

* * * * * * *



**13.1. Moistureproofing and fungiproofing.**—(Added.) *a. General.*—The operation of Signal Corps equipment in tropical areas where temperature and relative humidity are extremely high requires special attention. The following items represent problems which may be encountered in operation:

(1) Capacitors, coils, and transformer windings fail.

(2) Electrolytic action takes place in coils and transformer windings, causing eventual break-down.

(3) Hook-up wire and cable insulation break down. Fungus growth accelerates deterioration.

(4) Moisture forms electrical leakage paths on insulating strips, causing flash-overs.

(5) Moisture provides leakage paths between battery terminals.

*b. Treatment.*—A moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection against fungus growth, insects, corrosion, salt spray, and moisture. The treatment involves the use of a moisture- and fungi-resistant varnish applied by a spray gun or brush. Refer to TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment, for a detailed description of the varnish-spray method of moistureproofing and fungiproofing and the supplies and equipment required in this treatment.

AGO 76C 822603°—45

***Caution:*** Varnish spray may have toxic effects if inhaled. To avoid inhaling spray, use respirator if available; otherwise, fasten cheesecloth or other cloth material over nose and mouth.

*c. Step-by-step instructions for treating converter M-222* (figs. 13 and 14).—(1) *Preparation.*—Make all repairs and adjustments necessary for the proper operation of the equipment.

(2) *Disassembly.*—(*a*) Release catches on battery compartment cover and remove cover. Remove batteries if installed.

(*b*) Remove cover of wiring compartment by removing the four screws which hold it in place.

(*c*) Remove vibrator unit by pulling it from plug receptacle.

(*d*) Remove cover from vibrator unit by removing the two screws at ends of vibrator unit case.

(*e*) Clean all dirt, dust, rust, fungus, oil, and grease from the equipment.

(3) *Masking.*—(*a*) Mask bare ends of battery connecting wires (fig. 13).

(*b*) Mask vibrator unit plug receptacle (fig. 14).

(*c*) Mask vibrator unit contact spring (fig. 14).

(4) *Drying.*—Place equipment in oven or under heat lamps and dry for 2 to 3 hours at 140° F.

(5) *Varnishing.*—Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, Spec. No. 71-2202 (Stock No. 6G1005.3), or equal) with spray gun to the following parts:

(*a*) Battery compartment (fig. 13).

(*b*) Battery connecting wires (fig. 13).

(*c*) Transformer, vibrator unit, and wiring compartment (fig. 14).

(*d*) Inside of vibrator unit case and vibrator unit cover (fig. 14).

(6) *Reassembly.*—(*a*) Remove all masking tape.

(*b*) Clean all contacts with varnish remover, and burnish the contacts.

(*c*) Reassemble the equipment and test for proper operation of circuit elements.

(7) *Marking.*—Mark the equipment with "MFP" and the date of treatment. Place this marking near the nameplate or, if there is no nameplate, place it in a conspicuous location.

*Example:* MFP—8 July 1944.

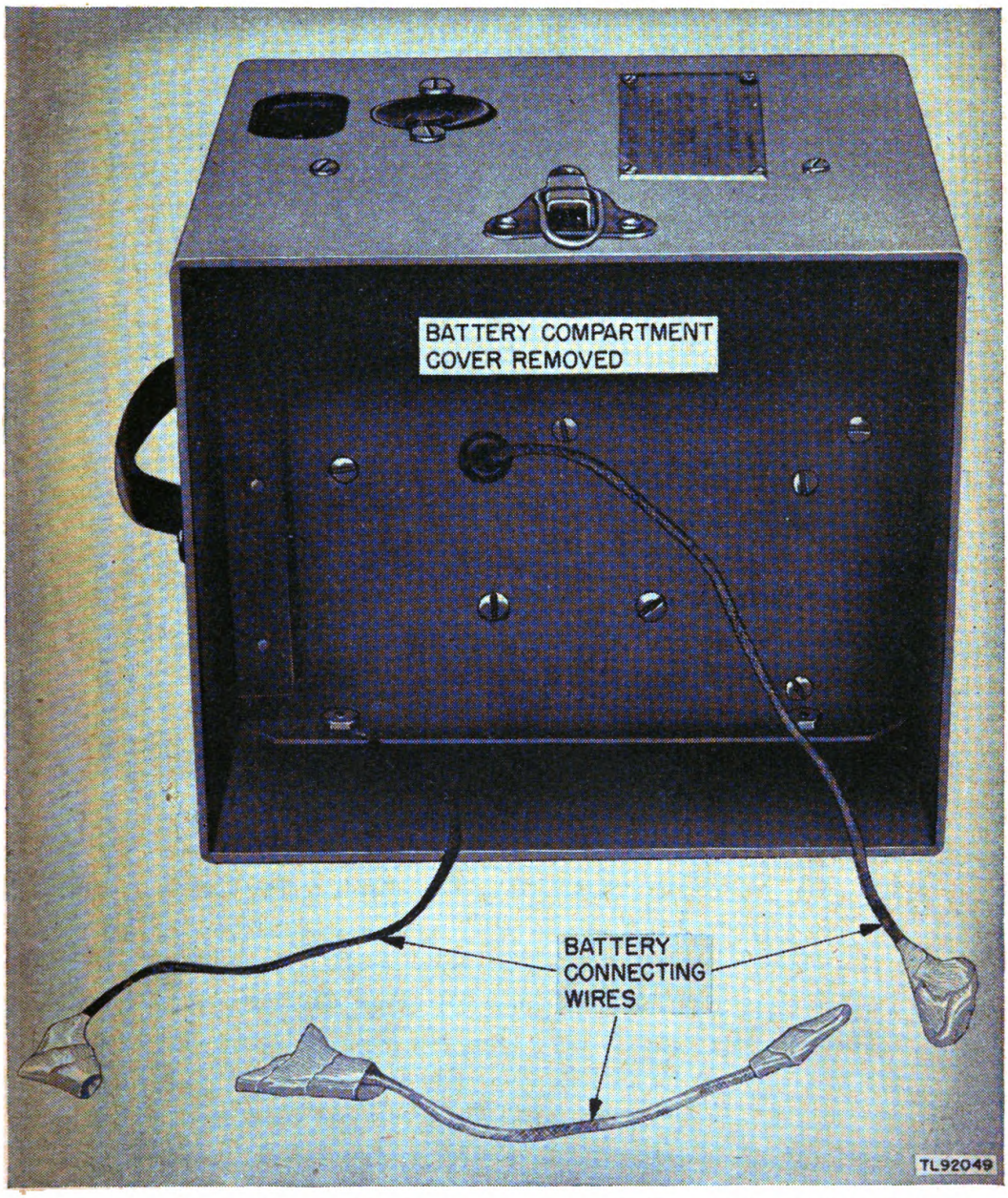



FIGURE 13.—Converter M-222—battery compartment, battery connecting wires masked.

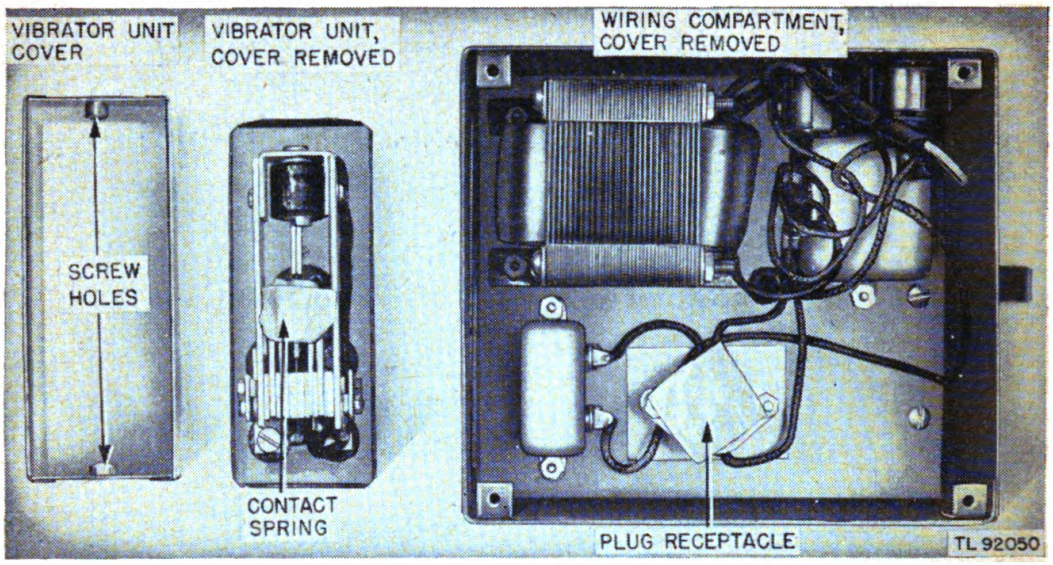



FIGURE 14.—Converter M-222—inside of chassis, vibrator unit removed.

[AG 300.7 (10 Oct 44)]

BY ORDER OF THE SECRETARY OF WAR:

OFFICIAL:
J. A. ULIO
*Major General*
*The Adjutant General*

G. C. MARSHALL
*Chief of Staff*

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For explanation of symbols, see FM 21-6.

TECHNICAL MANUAL
No. 11-344

WAR DEPARTMENT,
WASHINGTON, January 8, 1943.

# CONVERTER M-222

## DESTRUCTION NOTICE

**Should it become necessary to abandon the converter in the combat zone, it should be destroyed by smashing with a hammer or other heavy object.**

## SAFETY NOTICE

**KEEP AWAY FROM LIVE CIRCUITS. Operation of this equipment involves the use of high voltages which are dangerous to human life. Operating personnel must at all times observe all safety regulations. Operate switch to OFF before removing cover.**



502279°—43

## SECTION I

# DESCRIPTION



**1. General.**—Converter M–222 is designed to supply emergency ringing current for telephone switchboards. Two Signal Corps batteries BA–23, in series, are used as a source of power. Converter M–222 is supplied without the batteries, which must be installed as described in paragraph 4*b*. The output is 100 volts alternating current open circuit, or 50 volts alternating current with a 5-watt load. The peak voltage does not exceed 250 volts alternating current. The frequency of the output voltage is 24 cycles ± 4 cycles.

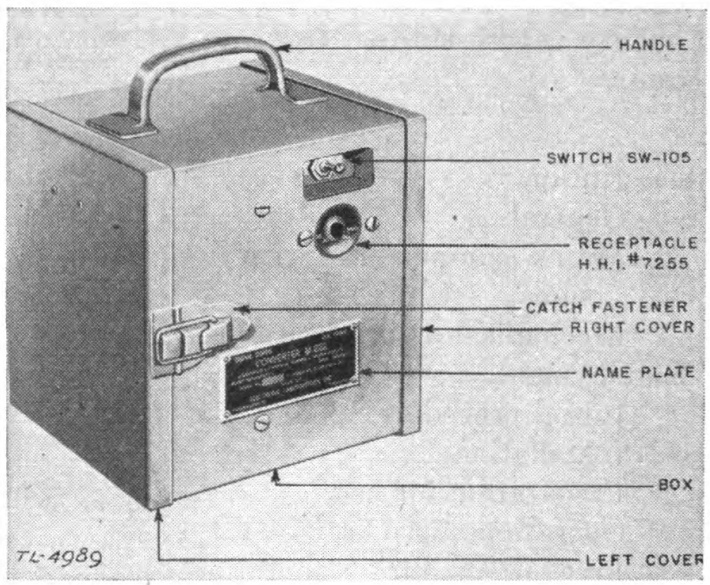


FIGURE 1.—Converter M–222—outside view.

**2. Major components with weights and dimensions.**—*a.* Dimensions and weight of converter M–222 are as follows (see fig. 1):

| | |
|---|---|
| Height | 8¼ inches maximum |
| Width | 6¾ inches maximum |
| Depth | 6⅝ inches maximum |
| Weight (without batteries) | 11 pounds |
| Weight (with batteries installed) | 15¼ pounds |

*b.* Converter M–222 includes the following major components:

| *Name* | *Weight (lbs.)* |
|---|---|
| 1 each box | 2.54 |
| 1 each cover, right | .8 |
| 1 each cover, left | .84 |
| 1 each mounting shelf assembly | 5.12 |
| 1 each vibrator | 1.19 |
| 2 each preliminary instructions for converter | |

**3. Mechanical description.**—Converter M–222 consists essentially of the following assemblies:

*a. Mounting shelf assembly.*—The mounting shelf assembly consists of a shallow steel shelf on which are mounted the following components: on the top of the mounting shelf assembly are mounted one transformer (E. L. I. T–521–A), one 0.25-$\mu$f capacitor CA–385, one 1-$\mu$f capacitor CA–234, and one vibrator (S–814–V–E. L. I.). The vibrator is encased in a metal box and is held in place by two steel clips which are welded to the cover. The vibrator (S–814–V–E. L. I.) plugs into a six-prong socket (A. P. C. MIP6). A phenolic strip is mounted on the under side of the mounting shelf assembly directly under capacitor CA–234. The mounting shelf assembly is fastened to the box by means of four No. 6–32 flat top, binding head screws. (See fig. 2.)

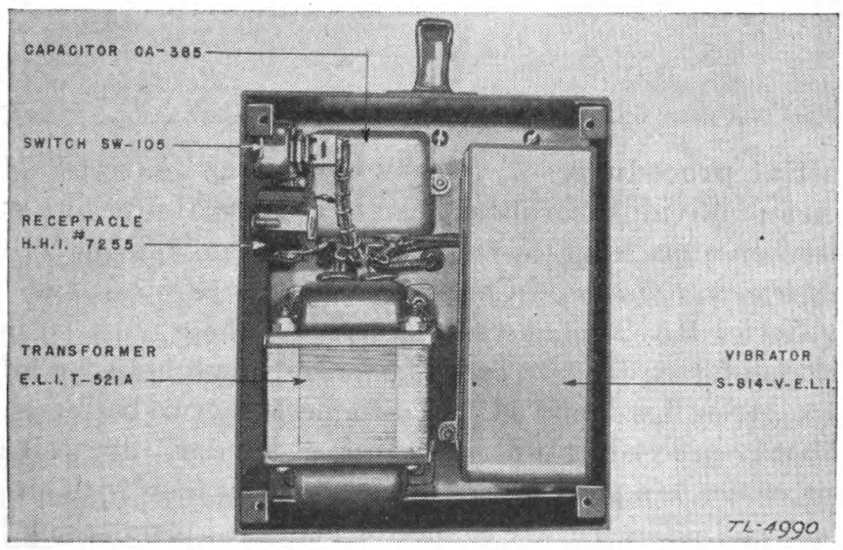


FIGURE 2.—Converter M–222—inside of chassis.

*b. Box.*—The box (figs. 1 and 2) is a rectangular, steel box with two opposite sides removable. On the front panel are mounted one receptacle (H. H. I. No. 7255), one name plate, the lower section of one catch fastener, and one switch SW–105. The switch is mounted in

a recess in the panel. The ON and OFF positions of the switch are marked on this panel as shown in figure 1. A handle is welded to the top of the box, and the lower section of the other catch fastener is mounted on the back of the box. The mounting shelf assembly is fastened to this box in the position shown in figure 2, which leaves a space on the left-hand side for installing batteries.

*c. Right cover.*—The cover to the right of the name plate, when the operator is facing the converter, is fastened to the box by means of four No. 8–32 round head screws, which fasten into four tapped angle brackets welded in the corners of the box. Two steel clips are welded to the back of this cover. When the cover is in place, these clips fit over the vibrator and hold it securely. The circuit label is attached to the inside of the right cover.

*d. Left cover.*—The left cover has two spring clips mounted on the inside to hold the batteries in place. The upper section of the two catch fasteners, used to fasten the cover to the box, are mounted on the sides of the left cover.

## Section II

## EMPLOYMENT



**4. Initial procedure.**—*a. Unpacking.*—Each converter M–222 is packed in an individual cardboard carton. Normal precaution should be taken when unpacking the converter, so that no damage will result.

*b. Battery installation.*—Converter M–222 requires two Signal Corps batteries BA–23 connected in series. These must be installed as follows: unfasten the two catch fasteners which hold the left cover to the box. (See figs. 3 and 11.) To connect the two batteries to converter M–222, proceed as follows, using a standard dry cell battery connector, which is a piece of green wire 5 inches long with a terminal lug on each end. The battery connector is packed inside the left cover and is fastened to the spring clips. Note the polarity of terminals on the battery. The *outside* terminal is negative. Unscrew the knurled nut on positive (center) terminal on battery No. 1 (as shown in fig. 3) and place one connector terminal lug over the screw on that battery terminal. Replace the knurled nut and fasten securely. Con-

nect the other connector terminal lug to the negative (outside) terminal on battery No. 2 (as shown in fig. 3) in the same manner. Connect the green wire (which has one end grounded to the chassis) to the positive (center) terminal on battery No. 2. Connect the red wire (which has one end connected to the switch) to the negative (outside) terminal on battery No. 1. Place the batteries in the box with the terminals toward the fibre insulator across the top. Push the batteries toward the bottom of the box, so that they fit below the phenolic strip which is mounted in front of the insulator. Replace the cover and fasten catch fasteners. The spring clips mounted on the cover will hold the batteries firmly in place.

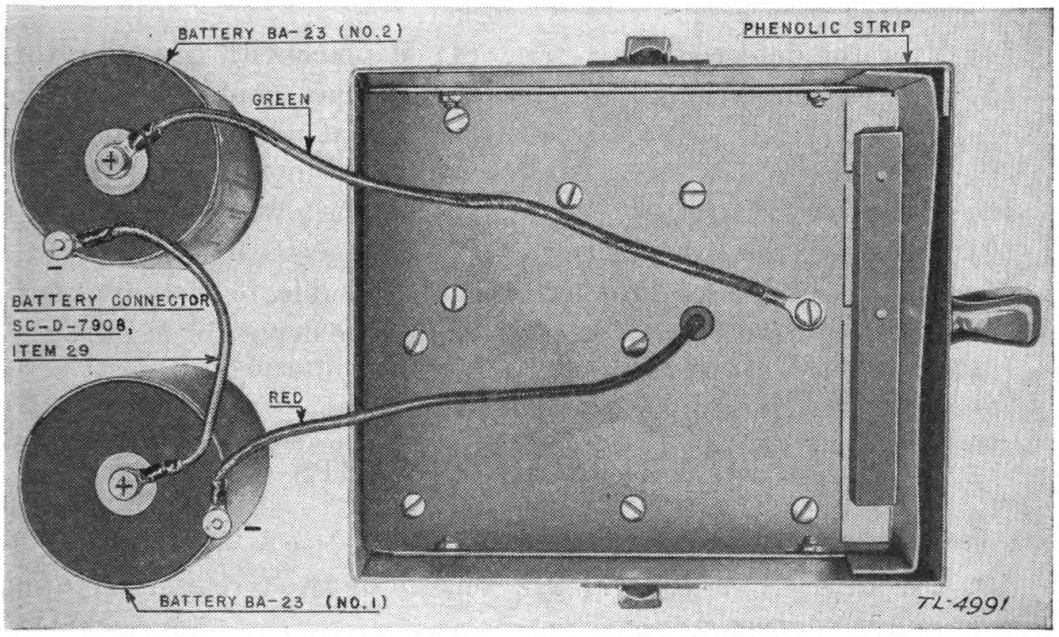


FIGURE 3.—Converter M-222—showing installation of batteries.

*c. Mechanical check.*—Remove the four No. 8-32 round head steel screws which hold the right cover in place. Remove right cover. Inspect all wires and soldered joints for loose connections. Check vibrator (S-814-V-E. L. I.) to make sure it is seated firmly in socket. Replace cover and screws.

**5. Installation.**—To prepare converter M-222 for operation, plug the line leading from the bell-ringing equipment into the receptacle (H. H. I. No. 7255).

**6. Preparation for use.**—*a.* Make sure that batteries are installed and connected correctly. (See par. 4*b*.)

*b.* Make sure that batteries are reasonably fresh.

**7. Operation.**—To start converter M-222, throw switch SW-105 to ON. To stop converter M-222, throw switch SW-105 to OFF.

**8. Precautions during operation.**—*When converter is not in use always throw switch to OFF to prevent batteries from being discharged.*

**9. Adjustments for field upkeep.**—*a.* If operation is not obtained and the vibrator does not operate, check the following probable sources of trouble:

| *Trouble* | *Remedy* |
|---|---|
| (1) One or both batteries defective. | (1) Replace with new battery BA-23. |
| (2) Batteries incorrectly connected. | (2) Correct connections. (See par. 4*b*.) |
| (3) Vibrator loose from socket. | (3) Replace vibrator firmly in socket. |
| (4) Vibrator defective. | (4) Replace with new vibrator. |
| (5) Broken connections. | (5) Replace connections, making sure that new connections are clean and secure. |
| (6) Defective switch. | (6) Replace with new switch. |
| (7) Damaged components. | (7) Replace. |

*b.* If the above checks do not correct the trouble, or if spare parts are not available, return converter M-222 to the depot for repair.

## SECTION III

## FUNCTIONING OF PARTS



**10. Circuits.**—Converter M-222 consists of two circuits, the input circuit and the output circuit.

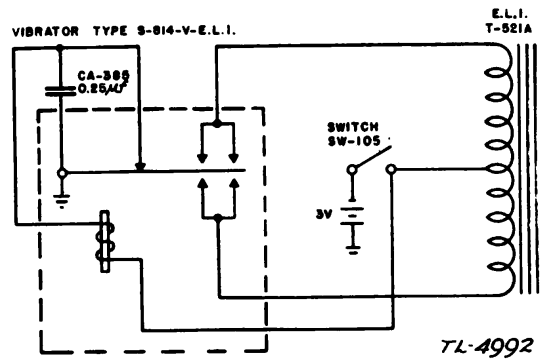


FIGURE 4.—Converter M-222—functional diagram of input circuit.

*a. Input circuit.*—The input circuit (fig. 4) consists of the vibrator (S-814-V-E.L.I.), the tapped transformer primary, the ON-OFF switch SW-105, and the actuating point capacitor CA-385. Its

operation is as follows: the input current flows through switch SW-105, the vibrator coil, the vibrator actuating point, the vibrator center reed, and back to the source of supply. (See fig. 5.) This starts the vibrator, causing the center reed to make contact with one set of side reeds. The actuating point capacitor CA-385 quenches the arc caused by the opening of the actuating point. With one set of side reeds closed, current flows through the center tap of the trans-

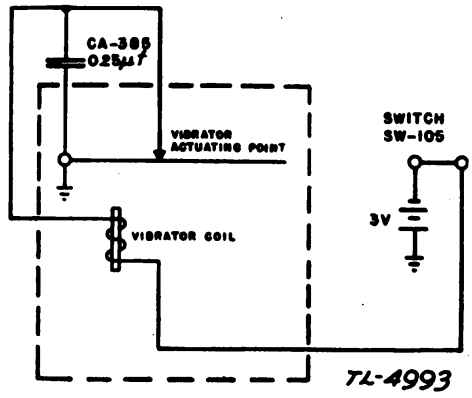


FIGURE 5.—Converter M-222—functional diagram of vibrator actuating point circuit.

former, one-half of the transformer winding, one set of the vibrator side reeds, the vibrator center reed, and back to the source of supply. (See fig. 6.) On the other half cycle of the vibrator, an exactly similar circuit may be traced through the other half of the transformer

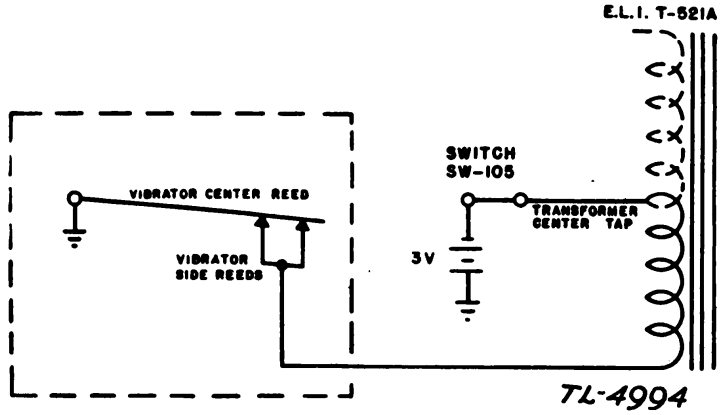


FIGURE 6.—Converter M-222—functional diagram of vibrator circuit, first half cycle.

and the other set of side reeds of the vibrator. (See fig. 7.) The reversal of direction of current flow in the primary produces alternating magnetic flux in the iron core of the transformer.

*b. Output circuit.*—The output circuit consists of the transformer secondary, one buffer capacitor CA-234, and the receptacle (H. H. I. No. 7255). The reversal of direction of flow in the primary produces

alternating magnetic flux in the transformer core, thus producing alternating current in the secondary. The buffer capacitor regulates the manner in which the magnetic flux decays in the transformer core during the intervals when the primary circuit is open by the operation of the vibrator. The receptacle is connected across the output terminals of the transformer. (See fig. 8.)

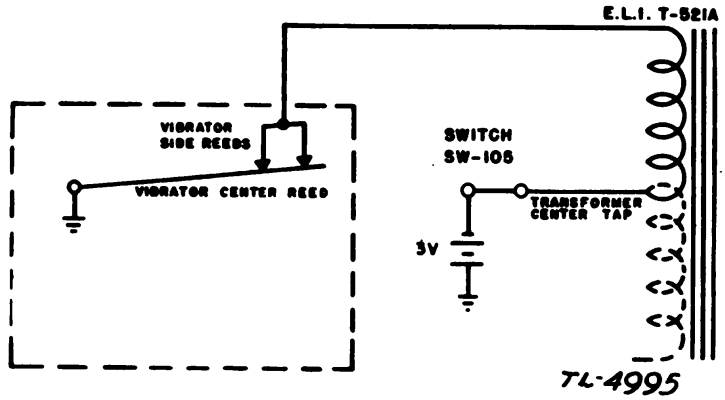


FIGURE 7.—Converter M–222—functional diagram of vibrator circuit, second half cycle.

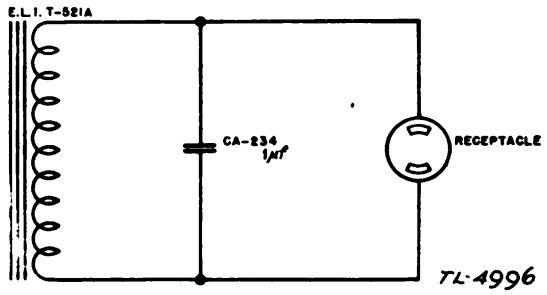


FIGURE 8.—Converter M–222—functional diagram of output circuit.

## SECTION IV

## MAINTENANCE



**11. Inspection to determine proper operation.**—*a.* Throw the switch SW–105 to ON. Feel the box to determine whether or not the vibrator is operating. If the vibrator is in operation, there will be a noticeable vibration of the box.

*b.* Refer to the instructions for operating the bell-ringing equipment. Check the bell-ringing equipment for proper operation.

*c.* The correct output of the converter M–222 may be checked by following the instructions outlined in paragraph 13*b*.

**12. Replacing parts.**—Remove the four No. 8-32 round head steel screws which hold the right cover in place. Remove the right cover. (See figs. 1 and 2.)

*a. Vibrator.*—Pull the vibrator directly away from the mounting shelf until the prongs on the base of the vibrator are disengaged from the socket. Before inserting a new vibrator, note the indexing of the socket. Place the vibrator into the socket so that the two large prongs on the vibrator plug fit into the corresponding holes marked No. 1 and No. 6 in the socket.

*b. Other components.*—Components other than the vibrator should rarely require replacement. Should any components have to be replaced, make sure that all connections are clean and secure. Check the wiring with wiring diagram (fig. 11) and schematic diagram (fig. 10). After changing any part, be sure the box, chassis, and wired parts are thoroughly cleaned and free from superfluous particles of solder.

**13. Circuit test.**—*a. Point to point check.*—A test of the circuit may be made by a point to point check. Refer to test schematic diagram (fig. 9) for location of points. The meters necessary for the test are an a-c voltmeter, 0 to 150 volts, rectifier type, 2,000 ohms per volt; an a-c voltmeter, 0 to 10 volts; d-c voltmeter, 0 to 5 volts; a low resistance range ohmmeter.

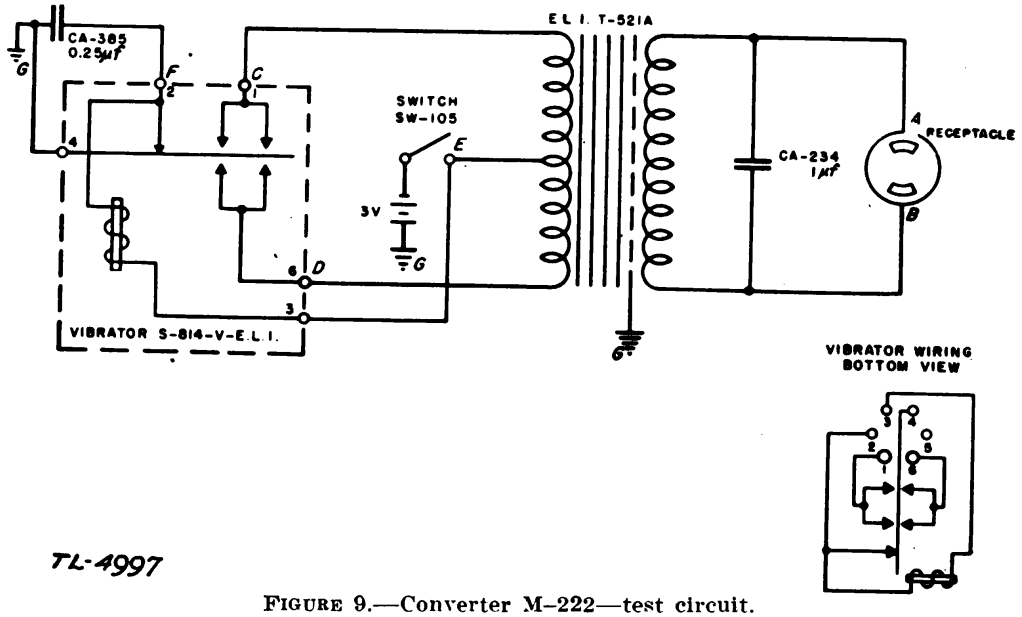


FIGURE 9.—Converter M-222—test circuit.

(1) *Voltage test.*—With the input voltage from the batteries 3.1 volts direct current, switch SW-105 thrown to ON, and with no load, the readings should approximate the following:

| *Points* | *Readings (volts)* | *Meter* |
|---|---|---|
| A to B | 120 a-c | 0 to 150 a-c voltmeter |
| A to G | 0.0 | |
| C to D | 5.7 a-c | 0 to 10 a-c voltmeter |
| C to E | 2.85 a-c | 0 to 10 a-c voltmeter |
| D to E | 2.85 a-c | 0 to 10 a-c voltmeter |
| E to G | 3 d-c | 0 to 5 d-c voltmeter |

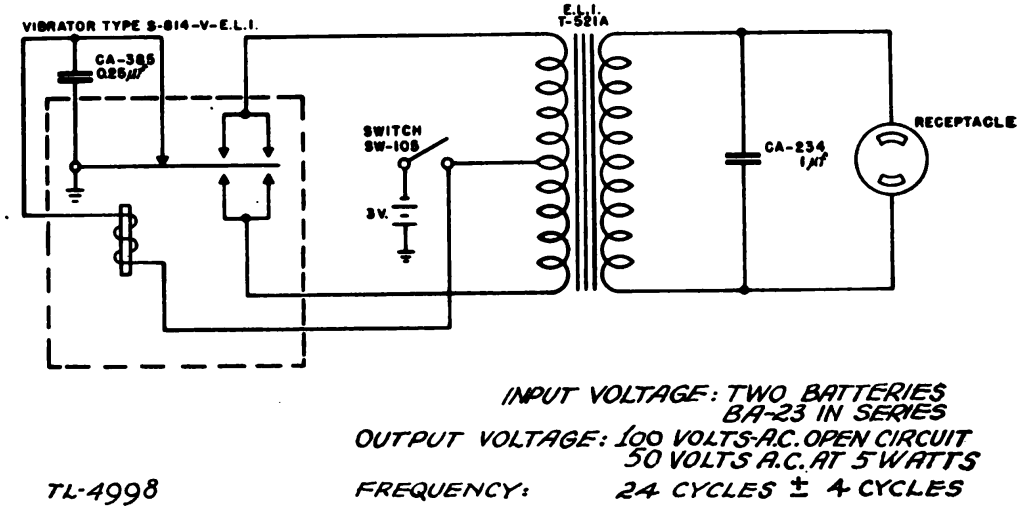


FIGURE 10.--Converter M–222—schematic diagram.

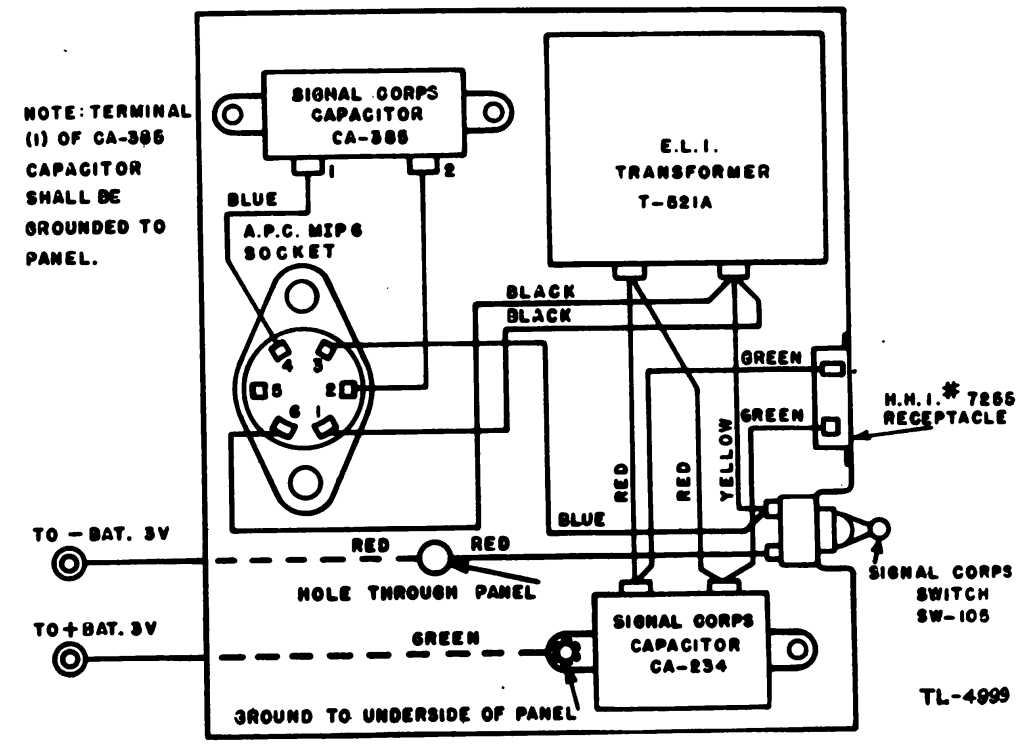


FIGURE 11.—Converter M–222—wiring diagram.

(2) *Resistance test.*—Throw the switch to OFF. Use a low resistance range ohmmeter. The following approximate readings should be obtained:

| *Points* | *Resistance (ohms)* |
|---|---|
| A to B | 85 |
| A to G | Infinity |
| C to D | 0.3 |
| C to E | 0.15 |
| D to E | 0.15 |
| E to F | 6 |
| E to G | 6 |

*b. Current output test.*—Using reasonably fresh batteries BA-23, the output into a noninductive circuit should be as shown below. The resistance of the output circuit includes that of the measuring instrument, which should be of the thermocouple or equivalent type to avoid errors due to waveform. Values listed in the following table are the minimum output.

| *Resistance (ohms)* | *Minimum output (milliamperes)* |
|---|---|
| 200 | 110.0 |
| 1,000 | 52.0 |
| 10,000 | 8.5 |
| 100,000 | 0.9 |

*c. Diagrams.*—Figures 10, 11, and 12 show the schematic and wiring diagrams and outline drawings respectively.

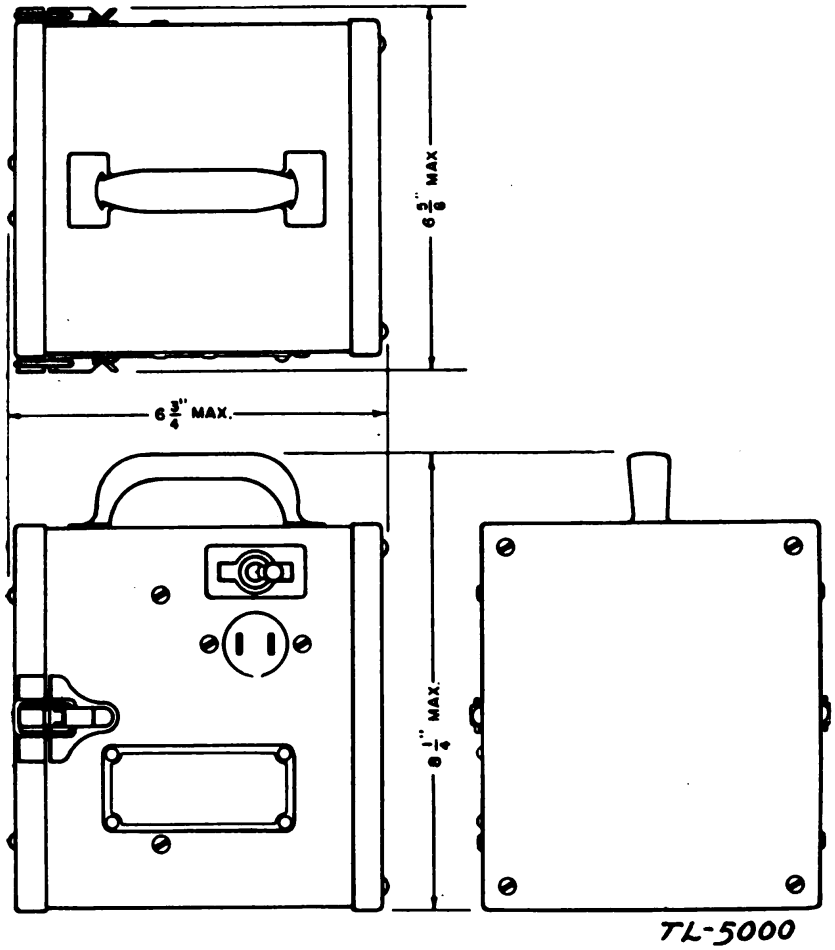


FIGURE 12.—Converter M–222—outline drawing.

## SECTION V

## SUPPLEMENTARY DATA

## 14. Components, weights, and dimensions.

| No. required | Article | Dimensions (inches) | | | | Unit weight (pounds) | Mfr. drawing No. | Signal Corps drawing No. |
|---|---|---|---|---|---|---|---|---|
| | | Height | Width | Depth | Diameter | | | |
| | Box assembly: | | | | | | | |
| | 1 box | | | | | | | SC-D-7909 |
| 1 | 4 brackets | | | | | | | SC-D-7910, item 4 |
| | 2 catch fasteners | 8¼ | 6¾ | 6⅝ | | 2. 54 | A-325 | |
| | 1 handle | | | | | | | |
| | 1 switch mounting | | | | | | | |
| 1 | Connector, battery | | | | | | S-226 | SC-D-7908, item 29 |
| | Cover assembly, right: | | | | | | | |
| 1 | 1 cover | 6 13/16 | 5 13/16 | ½ | | . 8 | A-447 | SC-D-7910, item 3 |
| | 2 clips | | | | | | | SC-D-7911, item 6 |
| | Cover assembly, left: | | | | | | | |
| 1 | 1 cover | 6 13/16 | 5 13/16 | ½ | | . 84 | A-450 | SC-D-7910, item 2 |
| | 2 clips | | | | | | | SC-D-7911, item 8 |
| 1 | Insulator | 2½ | 5 21/32 | ¾ | | | | |
| 1 | Label, circuit | | | | | | F-1450 | SC-D-7914-B |
| | Mounting shelf assembly: | | | | | | | |
| | 1 capacitor CA-234 | | | | | | | |
| | 1 capacitor CA-385 | | | | | | | |
| | 1 grommet | | | | | | | |
| 1 | 1 insulator | 6 21/32 | 3⅝ | 5 1/16 | | 5. 12 | | SC-D-7912 |
| | 1 mounting shelf | | | | | | | |
| | 1 socket, 6-prong | | | | | | | |
| | 2 spacers | | | | | | | |
| | 1 terminal, brass, tinned | | | | | | | |

| No. required | Article | Dimensions (inches) | | | | Unit weight (pounds) | Mfr. drawing No. | Signal Corps drawing No. |
|---|---|---|---|---|---|---|---|---|
| | | Height | Width | Depth | Diameter | | | |
| 1 | 1 transformer assembly including:<br>1 transformer<br>1 half shell<br>1 half shell (with two grommet holes)<br>2 grommets, rubber | | | | | | | |
| 1 | Name plate | | | | | | F-1449 | |
| 1 | Receptacle | | | 1 | 1¼ | .08 | S-281 | |
| 1 set | Rivets | | | | | | | |
| Do | Screws, nuts, and lockwashers | | | | | | | |
| 1 | Strip, phenolic | ½ | 4⅜ | ½ | | | L-926 | SC-D-7910, item 5 |
| 1 | Switch, toggle | 1⅝ | 1 | ½ | | | E-79 | |
| 4 | Terminals, brass, tinned | | | | | | U-524 | SC-D-7908, item 17 |
| 1 | Vibrator | 3 5/16 | 5⅜ | 2¼ | | 1.18 | AA-1119 | |
| 13 inches | Wire #18 A. W. G. blue | | | | | | | |
| Do | Wire #18 A. W. G. red | | | | | | | |
| 20 inches | Wire #18 A. W. G. green | | | | | | | |
| 2 inches | Sleeving, single saturated, turbo 3 mm. | | | | | | | |

## 15. Table of replaceable parts.

| Stock No. | Name | Description | Function | Mfr. code | Drawing or specification No. |
|---|---|---|---|---|---|
| | Socket | 6 contact molded phenolic, type MIP6. | Vibrator socket | A. P. C. | |
| | Capacitor CA–385 | 0.25-$\mu$f, 200-volt d-c | Vibrator actuating point suppression. | | SC–D–512 |
| 3D234 | Capacitor CA–234 | 1-$\mu$f, 200-volt d-c | Output buffer | | Spec. 71–516 |
| | Receptacle | 2 contact molded phenolic, type 7255. | Output voltage connection | H. H. I. | |
| 3Z8105 | Switch SW–105 | Toggle | Input voltage ON-OFF switch. | | SC–A–1042 |
| | Transformer | 3 volts d-c vibrator input, 100 volts a-c output, type T–521–A. | Power | E. L. I. | |
| | Vibrator | 3 volts 24 cycles ± 4 cycles, type S–814–V. | To change input d-c voltage to a-c and apply it to the transformer. | E. L. I. | |
| | Battery connector | Green wire 5 inches long, #18 A. W. G. with a terminal lug on each end. | To connect two batteries | | SC–D–7908 (item 29) |

| No. required | Article | Dimensions (inches) | | | | Unit weight (pounds) | Mfr. drawing No. | Signal Corps drawing No. |
|---|---|---|---|---|---|---|---|---|
| | | Height | Width | Depth | Diameter | | | |
| 1 | 1 transformer assembly including: | | | | | | | |
| | 1 transformer | | | | | | | |
| | 1 half shell | | | | | | | |
| | 1 half shell (with two grommet holes) | | | | | | | |
| | 2 grommets, rubber | | | | | | | |
| 1 | Name plate | | | | | | F-1449 | |
| 1 | Receptacle | | | 1 | 1¼ | .08 | S-281 | |
| 1 set | Rivets | | | | | | | |
| Do | Screws, nuts, and lockwashers | | | | | | | |
| 1 | Strip, phenolic | ½ | 4⅜ | ½ | | | L-926 | SC-D-7910, item 5 |
| 1 | Switch, toggle | 1⅝ | 1 | ½ | | | E-79 | |
| 4 | Terminals, brass, tinned | | | | | | U-524 | SC-D-7908, item 17 |
| 1 | Vibrator | 3 5/16 | 5⅜ | 2¼ | | 1.18 | AA-1119 | |
| 13 inches | Wire #18 A. W. G. blue | | | | | | | |
| Do | Wire #18 A. W. G. red | | | | | | | |
| 20 inches | Wire #18 A. W. G. green | | | | | | | |
| 2 inches | Sleeving, single saturated, turbo 3 mm. | | | | | | | |

## 15. Table of replaceable parts.

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|---|---|---|---|---|---|
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| | Capacitor CA–385 | 0.25-$\mu$f, 200-volt d-c | Vibrator actuating point suppression. | | SC–D–512 |
| 3D234 | Capacitor CA–234 | 1-$\mu$f, 200-volt d-c | Output buffer | | Spec. 71–516 |
| | Receptacle | 2 contact molded phenolic, type 7255. | Output voltage connection | H. H. I. | |
| 3Z8105 | Switch SW–105 | Toggle | Input voltage ON-OFF switch. | | SC–A–1042 |
| | Transformer | 3 volts d-c vibrator input, 100 volts a-c output, type T–521–A. | Power | E. L. I. | |
| | Vibrator | 3 volts 24 cycles ± 4 cycles, type S–814–V. | To change input d-c voltage to a-c and apply it to the transformer. | E. L. I. | |
| | Battery connector | Green wire 5 inches long, #18 A. W. G. with a terminal lug on each end. | To connect two batteries | | SC–D–7908 (item 29) |

**16. List of manufacturers.**

| *Code* | *Name* | *Address* |
|---|---|---|
| A. P. C. | American Phenolic Co. | Chicago, Ill. |
| E. L. I. | Electronic Laboratories, Inc. | Indianapolis, Ind. |
| H. H. I. | Harvey Hubbel, Inc. | Bridgeport, Conn. |

[A. G. 062.11 (12–10–42).]

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